Explanation of Significant Differences
Brookhaven National Laboratory Site
Upton, New York

Introduction to the Site and Statement of Purpose

The groundwater cleanup decisions at Brookhaven National Laboratory (BNL) are documented in the Operable Unit III (OU III) Record of Decision (ROD) approved by the U. S. Department of Energy (DOE) and the U. S. Environmental Protection Agency (EPA) with the concurrence of the New York State Department of Environmental Conservation (NYSDEC). The OU III ROD was approved in June 2000 and placed in the Administrative Record.

The OU III ROD establishes the cleanup decisions for several groundwater contamination plumes at Brookhaven. However, as described in the ROD and summarized below, there were three areas in which additional characterization and investigation were required in order to determine the required remedial actions:

Magothy Aquifer Contamination

When the OU III ROD was approved, the extent of the contamination in the Magothy Aquifer was uncertain. High concentrations of volatile organic compounds (VOCs) were identified in the Industrial Park and south of Carleton Drive; the lateral and vertical extent of contamination was not delineated. However, delaying the ROD until further Magothy characterization was performed would also delay the start of other OU III cleanups. Therefore, the OU III ROD directed that Magothy characterization should continue, and if necessary, a remedy developed.

Specifically, the ROD states: "At present, limited characterization has been performed in the Magothy, so additional characterization and installation of groundwater monitoring wells are planned. This work will be done during the design of the remedy, and will be included in the site records. When this characterization and monitoring is completed, the need for a remedy for the Magothy Aquifer will be evaluated by DOE, EPA, and NYSDEC. If a remedy for the Magothy Aquifer is necessary, either this Record of Decision will be modified or another decision document will establish the selected action. In either case, the public will have an opportunity to review and comment in accordance with CERCLA". Thus, the OU III ROD did not identify a remedy for the Magothy Aquifer.

Strontium-90 Groundwater Contamination

There are two strontium-90 (Sr-90) groundwater contamination plumes associated with OU III, on the BNL site: A plume downgradient of the former "Chemical Holes" disposal site, which is the source of the contamination, and a plume located in the middle of the BNL site. This plume is the result of historical leakage from the Brookhaven Graphite Research Reactor (BGRR) and the Waste Concentration Facility (WCF). The 1999 OU III Remedial Investigation and Feasibility Study (RI/FS) considered several remedial alternatives to address this contamination. "Pump and treat" using ion exchange technology was the remedy selected in the OU III ROD.

Notwithstanding the RI/FS conclusions, it was recognized that there were several technical uncertainties associated with extracting Sr-90 contamination from groundwater and the subsequent use of ion exchange technology to treat contaminated groundwater. These uncertainties are reflected in the ROD's mandate for a pilot study as a prerequisite to the final remedial design, and the recognition that the final remedy may be modified based on the results of this pilot study.

Specifically, the ROD states: "The selected remedy, alternative S5a, involves installing extraction wells and using ion exchange to remove Sr-90 from the extracted water and on-site discharge of the clean water. Details of the specific number of treatment systems and locations needed to meet the cleanup objectives will be determined during the design process. Before implementation of the remedy, a pilot treatability study will be performed to evaluate the effectiveness of extraction and treatment. The final remedy may potentially be modified based on the results of this study. Residuals that contain Sr-90 will be disposed of off-site".

Within draft BGRR ROD: pgs. 9, 34, 35

Building 96 Geophysical Anomalies

Historically, the area south of Building 96 was used as a scrap yard and for 55-gallon drum storage. Because this area was a potential source of VOC contamination, subsurface geophysical investigations were performed during 1999 that included ground-penetrating radar, magonetometer, and metal detector surveys. Several geophysical anomalies were identified indicating the potential presence of foreign or man-made objects buried in this area. Based on these results, exploratory excavation to investigate the anomalies was recommended, and if contamination was found, conduct the required cleanup of the area.

Soil & groundwater samples were obtained

The OU III ROD requires resolution of this potential soil contamination site: "The final remedy for potential source areas in Area of Concern (AOC) 26-B (Building 96), such as the anomalies discovered during the geophysical survey, will be documented in a subsequent ROD". The OU III ROD is otherwise silent

as to any cleanup requirements associated with the Building 96 geophysical anomalies.

As already described, the OU III ROD recognizes that the resolution of key uncertainties is a prerequisite to determining certain required remedial actions. The ROD mandates actions such as characterization, supplemental investigation, and a pilot study all directed towards resolution of these uncertainties. The ROD also anticipates additions and changes to remedial actions based on new and more complete data and information.

The purpose of this Explanation of Significant Differences (ESD) is to respond to these OU III requirements. This ESD summarizes the resolution to the remaining OU III uncertainties pursuant to the ROD. The ESD in turn documents resulting additions and changes to the OU III remedial actions as contemplated by the ROD.

Under the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), there are several methods for making changes to approved cleanup decisions. The DOE, EPA and NYSDEC have evaluated the changes described later in this ESD in accordance with Section 117 (c) of CERCLA and Section 300.435 (c)(2)(i) of the *National Oil and Hazardous Substances Pollution Contingency Plan* (NCP) and EPA guidance (EPA 540-R-98-031) on post-ROD changes and have concluded that an ESD is the appropriate procedural pathway. The DOE has included a voluntary 30-day period of public review prior to submission of the ESD for NYSDEC concurrence and EPA approval.

This ESD and other relevant documents will become part of the Administrative Record for the BNL site. The entire Administrative Record for BNL includes, among other things, the ROD and other relevant documents. These documents are available for review at the following locations:

Mastics-Moriches-Shirley Community Library
407 William Floyd Parkway
Shirley, NY 11967
Phone: (631) 399-1511

Brookhaven National Laboratory Research Library
Technical Information Division
Building 477A
Upton, NY 11973
Phone: (631) 344-3483

U. S. EPA – Region II Administrative Records Room
290 Broadway, 16th floor
New York, NY 10007
Phone: (21) 637-3185

SUMMARY OF SITE HISTORY, CONTAMINATION PROBLEMS, AND SELECTED REMEDY

BNL is a federal research facility owned by DOE. The 5,300-acre site is located in Upton, Suffolk County, New York, about 60 miles east of New York City. The EPA-designated sole source aquifer beneath BNL has three water-bearing units: the Upper Glacial, the Magothy, and the Lloyd Aquifers. These units serve as the primary source of drinking water for Nassau and Suffolk Counties.

In 1989, the BNL site was included on EPA's National Priorities List because of soil and groundwater contamination that resulted from past operations. The DOE, EPA, and NYSDEC then entered into a Federal Facilities Agreement that became effective in May 1992 and set the framework for the cleanup activities. The lead agency for remedial action at BNL is DOE. In addition, the Suffolk County Department of Health Services (SCDHS), while not a signatory to the IAG, has historically been and continues to be involved with cleanup work at BNL. To effectively manage remediation of the BNL site, 30 Areas of Concern (AOCs) were identified and divided into discrete groups called Operable Units (OUs). The BNL site is divided into six OUs. OU III was developed to address groundwater contamination in the central and southern portion of the site and in the off-site areas where groundwater contamination has migrated.

The 1999 RI/FS for OU III identified groundwater contaminated with VOCs on BNL property and outside BNL property, and tritium and Sr-90 in groundwater on BNL property. The cleanup objectives included in the OU III ROD to address this contamination are:

- Meet the drinking water standards in groundwater for VOCs, Sr-90, and tritium
- Achieve the goal of completing the cleanup of the Upper Glacial Aquifer in 30 years or less, and
- Prevent or minimize further migration of VOCs, Sr-90, and tritium in groundwater.

Active treatment using various treatment technologies assisted by natural attenuation was selected to meet these cleanup objectives.

As described previously, there were three areas for which the ROD mandated additional characterization and investigation before proceeding with a remedy:

Magothy Aquifer Contamination

limited characterization of had been performed.

When the OU III ROD was approved, the extent of the contamination in the Magothy Aquifer ~~was uncertain~~. High concentrations of VOCs were identified in the Industrial Park and south of Carleton Drive; the lateral and vertical extent of contamination was not delineated. However, delaying the ROD until further Magothy characterization was performed would also delay the start of other OU

and monitoring

stated that, when the characterization and monitoring were complete, the need for a Magothy remedy would be evaluated by DOE, EPA, and NYSDEC. The ROD went on to state that if a remedy for the Magothy Aquifer was necessary, either the ROD would be modified or another decision document would establish the selected action. In either case, the public would have an opportunity to review and comment in accordance with CERCLA.

III cleanups. Therefore, the OU III ROD directed that Magothy characterization should continue, a remedy developed, and then a decision made with input from the public.

Specifically, the ROD states: "At present, limited characterization has been performed in the Magothy, so additional characterization and installation of groundwater monitoring wells are planned. This work will be done during the design of the remedy, and will be included in the site records. When this characterization and monitoring is completed, the need for a remedy for the Magothy Aquifer will be evaluated by DOE, EPA, and NYSDEC. If a remedy for the Magothy Aquifer is necessary, either this Record of Decision will be modified or another decision document will establish the selected action. In either case, the public will have an opportunity to review and comment in accordance with CERCLA". Thus, the OU III ROD did not identify a remedy for the Magothy Aquifer.

Redundant - now since ref. on page 1 now!!

Strontium-90 Groundwater Contamination

There are two Sr-90 groundwater contamination plumes associated with OU III, on the BNL site: A plume downgradient of the former "Chemical Holes" disposal site, which is the source of contamination, and a plume located in the middle of the BNL site. This second plume is the result of historical leakage from the BGRR and WCF. The RI/FS considered several remedial alternatives to address this contamination. "Pump and treat" using ion exchange technology was the remedy selected in the OU III ROD.

Notwithstanding the RI/FS conclusions, it was recognized that there were several technical uncertainties associated with extracting Sr-90 contamination from groundwater and the subsequent use of ion exchange technology to treat contaminated groundwater. These uncertainties are reflected in the ROD's mandate for a pilot study as a prerequisite to the final remedial design, and the recognition that the final remedy may be modified based on the results of this pilot study.

Specifically, the ROD states: "The selected remedy, alternative S5a, involves installing extraction wells and using ion exchange to remove Sr-90 from the extracted water and on-site discharge of the clean water. Details of the specific number of treatment systems and locations needed to meet the cleanup objectives will be determined during the design process. Before implementation of the remedy, a pilot treatability study will be performed to evaluate the effectiveness of extraction and treatment. The final remedy may potentially be modified based on the results of this study. Residuals that contain Sr-90 will be disposed of off-site".

Building 96 Geophysical Anomalies

Historically, the area south of Building 96 was used as a scrap yard and for 55-gallon drum storage. Because this area was a potential source of VOC contamination, subsurface geophysical investigations were performed during 1999 that included ground-penetrating radar, magonetometer, and metal detector surveys. Several geophysical anomalies were identified indicating the potential presence of foreign or man-made objects buried in this area. Based on these results, exploratory excavation to investigate the anomalies was recommended, and if contamination was found, conduct the required cleanup of the area.

The OU III ROD requires resolution of this potential soil contamination site: "The final remedy for potential source areas in AOC 26-B (Building 96), such as the anomalies discovered during the geophysical survey, will be documented in a subsequent ROD". The OU III ROD is otherwise silent as to any cleanup requirements associated with the Building 96 geophysical anomalies.

BASIS FOR THE DOCUMENT

The DOE has completed the additional characterization of the Magothy Aquifer, the Sr-90 pilot study, and the investigation of the Building 96 geophysical anomalies, and the Sr-90 pilot study mandated by the OU III ROD. Several technical reports providing the detailed results and findings have been provided to the EPA, NYSDEC and SCDHS for review and comment. These reports have been finalized and are now in the Administrative Record. These results and findings have also been reviewed with the community and are summarized below:

Magothy Aquifer Contamination

The supplemental characterization of the Magothy Aquifer indicated that VOC contamination has infiltrated from the Upper Glacial Aquifer in certain locations.

Between April 2000 and August 2002, twenty-two vertical profiles and thirteen monitoring wells were installed and used to sample into the Magothy Aquifer. The results of these supplemental sampling and analysis events are illustrated in the attached Magothy Aquifer plume map (Figure 1) and summarized in Table 1. This information, along with pre-existing data (including fifteen monitoring wells), helped delineate both the horizontal and vertical extent of Magothy contamination.

Most of the areas investigated correspond to locations where the Magothy brown clay is absent (or a hole exists in the clay layer) thereby providing the mechanism for migration from the Upper Glacial Aquifer downward into the uppermost horizon of the Magothy Aquifer. The impacted groundwater in the overlying Upper Glacial Aquifer is considered to be the source of the Magothy contamination. Fate and transport modeling was also performed to project the estimated extent and duration of VOC impacts to the aquifer over time.

Further details of the investigation results are presented in the final Magothy Characterization Report (May 2003). The final report was provided to the EPA, NYSDEC and SCDHS. The report was also placed in the Administrative Record in June 2004.

Because of the plume in the Upper Glacial Aquifer, public water hook-ups were provided for homes in the area south of BNL. However, seven homes have not been hooked-up to public water and are still operating private wells. These wells are monitored periodically. Because the Magothy Aquifer is beneath the Upper Glacial Aquifer and private wells are typically not screened that deep, it is highly unlikely that the private wells will draw contaminated water from the Magothy Aquifer (Note: The DOE formally follows-up annually with the seven known homeowners that are not connected to public water offering them free annual testing of their private drinking water wells. The SCDHS is provided a copy of the letters and will continue to be kept informed.) Based on modeling projections, no other pathway for exposure to groundwater is expected for approximately 100 years when the groundwater discharges into the Carmans River.

Strontium-90 Groundwater Contamination

Original characterization identified two Sr-90 contamination plumes on the BNL site. There is a plume downgradient of the former "Chemical Holes" disposal site. Historical leakage from the BGRR and the WCF has also resulted in an Sr-90 contamination plume located in the middle of the BNL site. The highest Sr-90 concentrations originally found in these plumes were 769 picoCuries per liter (pCi/l) and 566 pCi/l for the Chemical Holes and BGRR/WCF plumes, respectively. Sr-90 groundwater contamination has not been detected in areas off of the BNL site.

During the fall of 2003 supplemental characterization was performed to support ongoing remedial design activities. Supplemental sampling and analysis indicate that the Sr-90 contamination plumes are generally of the same size, in the same location, and at the same depth as determined after the original characterization events. However, increased concentrations were found in the Chemical Holes and BGRR/WCF Sr-90 contamination plumes: 2,540 pCi/l and 3,150 pCi/l, respectively. Again, Sr-90 groundwater contamination has not been detected in areas off of the BNL site. These results are illustrated in the attached Sr-90 plume maps (Figures 2 & 3). Detailed characterization data and information were documented in a report that the DOE provided to the EPA, NYSDEC and SCDHS in March 2004. The report was placed in the Administrative Record in June 2004.

Pursuant to the OU III ROD the DOE designed, built and has been operating Sr-90 pilot treatment system since February 2003. The pilot study treatment system was built to treat the smaller contamination plume located downgradient of the former "Chemical Holes" disposal site. The pilot study has been highly effective in providing information that is useful and relevant in determining a remediation plan for Sr-90 groundwater contamination on the BNL site. Major pilot study findings are summarized below:

here

- Sr-90 can be effectively extracted from the aquifer. Even after 14 months of operating at low flow rates, the pilot treatment system continues to extract groundwater from the aquifer with significant concentrations (125 pCi/l) of Sr-90.
- The rate of ion exchange resin usage at the elevated flow rates considered in the RI/FS was significantly higher than anticipated. Although the ion exchange resin is effective in removing Sr-90 from the extracted groundwater, the minerals and other natural impurities in groundwater, contribute to a reduction of the service life of the resin. Hence, there is a disproportionately high rate of resin usage and low-level radioactive waste (LLRW) generation in relation to relatively small quantities of Sr-90 actually removed from the groundwater.
- At the flow rates shown in the RI/FS, this increased rate of resin exchange would result in an increase in the generation, transportation, and disposal of Low Level Radioactive Waste (LLRW) from 540 cubic feet per year to 2,800 cubic feet per year.
- The original estimated life-cycle project costs in the RI/FS and ROD, including treatment system operations and maintenance totaled $6,500,000. In order to meet the same cleanup objective contemplated in the RI/FS and ROD (i.e., Alternative S5a), and driven almost exclusively by increased resin usage, and increased LLRW packaging, transportation and disposal volumes, the life-cycle project costs are now estimated at $55,700,00.

The pilot study has demonstrated that Sr-90 can be extracted from the aquifer. However, a scaled up high flow system to treat Sr-90 groundwater contamination would generate enormous quantities of spent, contaminated resin that would need to be disposed of as LLRW. It would be cost prohibitive to operate the system contemplated in the RI/FS and ROD.

The pilot study results are documented in a detailed report prepared by the DOE and provided to the EPA, NYSDEC and SCDHS in December 2003. The report was placed in the Administrative Record in June 2004.

Building 96 Geophysical Anomalies

In March 2004, twenty-one exploratory excavations were performed that found no source areas of contamination. Pieces of concrete, scrap metal, and iron-stained soils were identified. One out-of-service cesspool was found that contained debris, a tire, and pieces of concrete. An endpoint sample of the cesspool was obtained that indicated it was suitable for backfilling. SCDHS reviewed the results, the debris was removed, and the cesspool was backfilled in September 2004.

A report was prepared and provided to the EPA, NYSDEC and SCDHS in November 2004. The report is now available on the BNL website and was placed in the Administrative Record in November 2004.

DESCRIPTION OF SIGNIFICANT DIFFERENCES AND THE REASONS FOR THOSE DIFFERENCES

The proposed changes to the OU III ROD are described below:

Magothy Aquifer

The OU III ROD does not identify a remedy for the Magothy Aquifer. As a result of supplemental characterization and analyses completed pursuant to this ROD, this ESD adds a remedy for the Magothy Aquifer.

The DOE's proposed remedy adds two Magothy Aquifer extraction wells to the three wells that have already been installed at the Magothy Aquifer/Upper Glacial Aquifer interface in connection with other groundwater treatment systems. This remedy, like most other groundwater remedies included in the OU III ROD, would rely on active treatment assisted by natural attenuation. Based on groundwater modeling, the Magothy Aquifer wells are planned to operate between 5 to 10 years followed by 55 to 60 years of natural attenuation. The duration required to reach drinking standards is 65 years. The total cost of adding this Magothy Aquifer remedy to the OU III ROD is $2,345,000.

As already discussed, there are no current receptors and hence, no known human health risks associated with this contamination in the Magothy Aquifer. Nonetheless, the DOE believes that it is prudent and conservative to proactively treat high concentrations of VOCs in Magothy Aquifer for the following reasons:

- Resource preservation of the sole source aquifer (consistent with the National Contingency Plan).
- Address the high concentrations now to limit plume growth.
- Prevent substantial contamination of the Magothy, which may warrant future treatment and require a longer and more costly cleanup.
- Manage uncertainties associated with long-term modeling projections.

Three alternatives were evaluated for remediation of the Magothy Aquifer contamination. They are described in detail in the Magothy Supplemental Alternatives Analysis, dated March 2004 and summarized in Table 2 (attached).

Alternative 2 is the remedy being proposed by the DOE. This remedy includes continued operation of the existing three extraction wells as part of the Upper Glacial treatment systems that provide capture of Magothy contamination. Two additional off-site Magothy extraction wells on Stratler Drive (south of Carleton Drive) and at the Industrial Park East location were recently installed to prevent migration of high concentrations of VOCs through the hole in the brown clay and into the Magothy Aquifer. Data from the monitoring wells will continue to be evaluated to ensure protectiveness. Table 3 describes how each of the Magothy investigation areas are addressed by the DOE's proposed Magothy Aquifer remedy.

The *Magothy Supplemental Alternatives Analysis* was provided to the EPA and NYSDEC in March 2004 and placed in the Administrative Record in June 2004.

Strontium-90

The OU III ROD relies on active "pump and treat" assisted by natural attenuation to reach drinking water standards in 30 years. The "Alternative S5a" treatment system described in the RI/FS and adopted in the ROD relies on two extraction wells operated at high flow rates. Because of the slow rate of Sr-90 migration in groundwater, and the significantly higher concentrations and distribution of Sr-90 it is unlikely that the "Alternative S5a" remedy would meet the 30-year goal. As previously discussed, the treatment of groundwater using ion exchange technology is effective for Sr-90 removal. However, the removal of minerals and other natural groundwater impurities contributes to a reduction of the service life of the resin at high flow rates. This in turn results in a significant increase in the rate of resin usage and LLRW generation relative to the relatively small amounts of Sr-90 actively removed from the groundwater. Increased resin usage and increased LLRW waste values have resulted in an almost ten-fold increase in the original $6.5 million life cycle cost estimate with little or no improvements in the performance and effectiveness of the "Alternative S5a" remedy. The DOE has evaluated other Sr-90 remedial alternatives in light of its pilot study operating experience with the objective of mitigating these weaknesses with the "Alternative S5a" remedy.

The existing pilot study treatment system would continue to be operated for approximately ten years to actively treat the Sr-90 plume downgradient of the former "Chemical Holes followed by 30 years of natural attenuation and radioactive decay. The total duration to meet drinking water standards for this plume is 40 years.

In view of the supplemental characterization data and pilot study findings, seven alternatives were considered for remediating Sr-90 groundwater contamination. They are described in the March 5, 2004 *Sr-90 Plume Alternatives Evaluation*. This report was provided to the EPA, NYSDEC and SCDHS in March 2004 and placed in the Administrative Record in June 2004. The alternatives evaluated by the DOE are summarized in Table 4 (attached).

At the BGRR/WCF Sr-90 contamination plume located in the center of the BNL site, DOE proposes to install five extraction wells and groundwater treatment system (ion exchange) using lessons learned during the installation, operation and maintenance of the pilot study treatment system. Based on models using the supplemental characterization data, the system would be operated for a period of approximately ten years, followed by 60 years of natural attenuation and radioactive decay. The total duration to meet drinking water standards is 70 years. Hence, the limiting duration to reach drinking water standards is 70 years in contrast to the 30-year objective in the OU III ROD. The total estimated life-cycle cost of the Sr-90 remedial alternative is $14 million.

It should be noted that neither plume is predicted to leave BNL property above drinking water standards and that no drinking-water wells are near this plume. It should be further noted that monitoring wells and a sampling program will continue to monitor the location and extent of the plume.

Alternative 3, described above, is the DOE's proposed alternative for the following reasons:

- This alternative provides for active treatment of the Sr-90 groundwater contamination and hence would be effective in controlling plume growth.
- According to groundwater modeling, the Sr-90 contamination in the BGRR/WCF plume would not migrate south of Princeton Avenue or within 6,000 feet of the BNL site boundary above drinking water standards. The Chemical Holes plume likewise would not migrate within 1,000 feet of the BNL site boundary. Because groundwater never exits the BNL site above drinking water standards, there are no receptors and hence no human health risks.
- This alternative provides a 1,800 cubic feet reduction in the packaging, transportation, and disposal of LLRW in comparison with the reference "Alternative S5a" treatment system.
- At $14 million and still more costly than the original projected $6.5 million, this alternative results in cost savings of more than $40 million in comparison with the reference "Alternative S5a" treatment system.
- There are no credible technical uncertainties and risks associated with the effectiveness of institutional controls relative to the 70-year duration required to reach Sr-90 drinking water standards.

Table 5 (attached) provides a summary of the proposed change described in this ESD to the Sr-90 remedy included in the OU III ROD.

Institutional Controls for the Groundwater Remediation Program

Institutional controls will also be in place to ensure effectiveness of these and all groundwater remedies. In accordance with the BNL *Land Use Management Plan*, dated August 2003, the following institutional controls will continue to be implemented for the groundwater remediation program:

- Groundwater monitoring, including BNL potable supply systems and SCDHS monitoring of Suffolk County Water Authority wellfields closest to BNL
- Five-year reviews as required by CERCLA will be conducted until cleanup goals are met and to determine the effectiveness of the groundwater monitoring program
- Prohibitions to the installation of new supply wells
- Public water service in plume areas south of BNL

- Prohibitions to the installation of new drinking water wells and other pumping wells where public water service exists (Suffolk County Sanitary Code Article 4)
- Property access agreements for treatment systems off of BNL property (deed transfer with property ownership change)

Due to the slow migration of Sr-90 in groundwater, and the slow groundwater flow of the Magothy Aquifer, there is ample time to respond to unexpected conditions or deviations in monitoring data for both plumes. An effective groundwater monitoring well network is vital to assure that the selected remediation approaches are performing as expected and to identify deviations. Monitoring well data trends and plume movement will be evaluated on an annual basis. Several sentinel wells will help monitor plume growth over time to ensure that the Sr-90 plumes remain within BNL property. Increasing trends of Sr-90 contamination in these wells will be evaluated, and if necessary, changes would be made. Changes could include installing additional monitoring wells or adding additional extraction wells.

In addition, during the required five-year reviews, a comprehensive evaluation will be performed to ensure that the plumes are behaving as expected and that the remediation approach continues to be protective of human health. During these reviews, DOE, EPA, and NYSDEC will evaluate if modification of the remedy is needed to ensure this protectiveness.

A certification will also be included in the BNL Annual Groundwater Status Report that the institutional controls established for groundwater remain effective. It will confirm that nothing has occurred that would impair the ability of the controls to protect human health or the environment or constitute a violation or failure to comply with any operation and maintenance requirements or BNL's Land Use Management Plan.

Building 96 Geophysical Anomalies

The OU III ROD did not identify a remedy for the geophysical anomalies. The ROD requires the investigation of these anomalies to determine whether or not they are irrelevant artifacts or true indications of substance soil contamination. In the event of the latter, some remedial action plan would then be required.

As already discussed, the geophysical anomalies have been investigated through exploratory excavation. There were no indications or evidence of soil contamination. In the case of the one cesspool that was discovered, soil samples were collected and analyzed for a full panel of VOCs and metals. No contamination was detected. In summary, the geophysical anomalies have been demonstrated to be irrelevant artifacts, and no further action is needed is necessary.

A report providing the details of the investigation was provided by the DOE to the EPA, NYSDEC and SCDHS in November 2004 and placed in the Administrative Record during the same month.

AFFIRMATION OF STATUTORY DETERMINATIONS

Considering the new information that has been developed, DOE, EPA, NYSDEC have determined that the remedy selected for the Magothy Aquifer and the Building 96 geophysical anomalies, as well as the changes to the Sr-90 remedy remain protective of human health and the environment, comply with Federal and State requirements that are applicable or relevant and appropriate to this remedial action, and are cost-effective. In addition, the remedies utilize permanent solutions and alternative treatment technologies to the maximum extent practicable for this site.

DOE, EPA, and NYSDEC believe that a change in the scope of the remedy has occurred in which a determination was made for: 1) the need for active treatment of the Magothy Aquifer and the installation of two additional off-site extraction wells, 2) additional time to achieve cleanup objectives and increased cost for Sr-90, and 3) the need to document the excavation and closeout of the geophysical anomalies at Building 96. Nevertheless, the agencies believe that this change does not fundamentally alter the remedy selected in the ROD or its appropriateness.

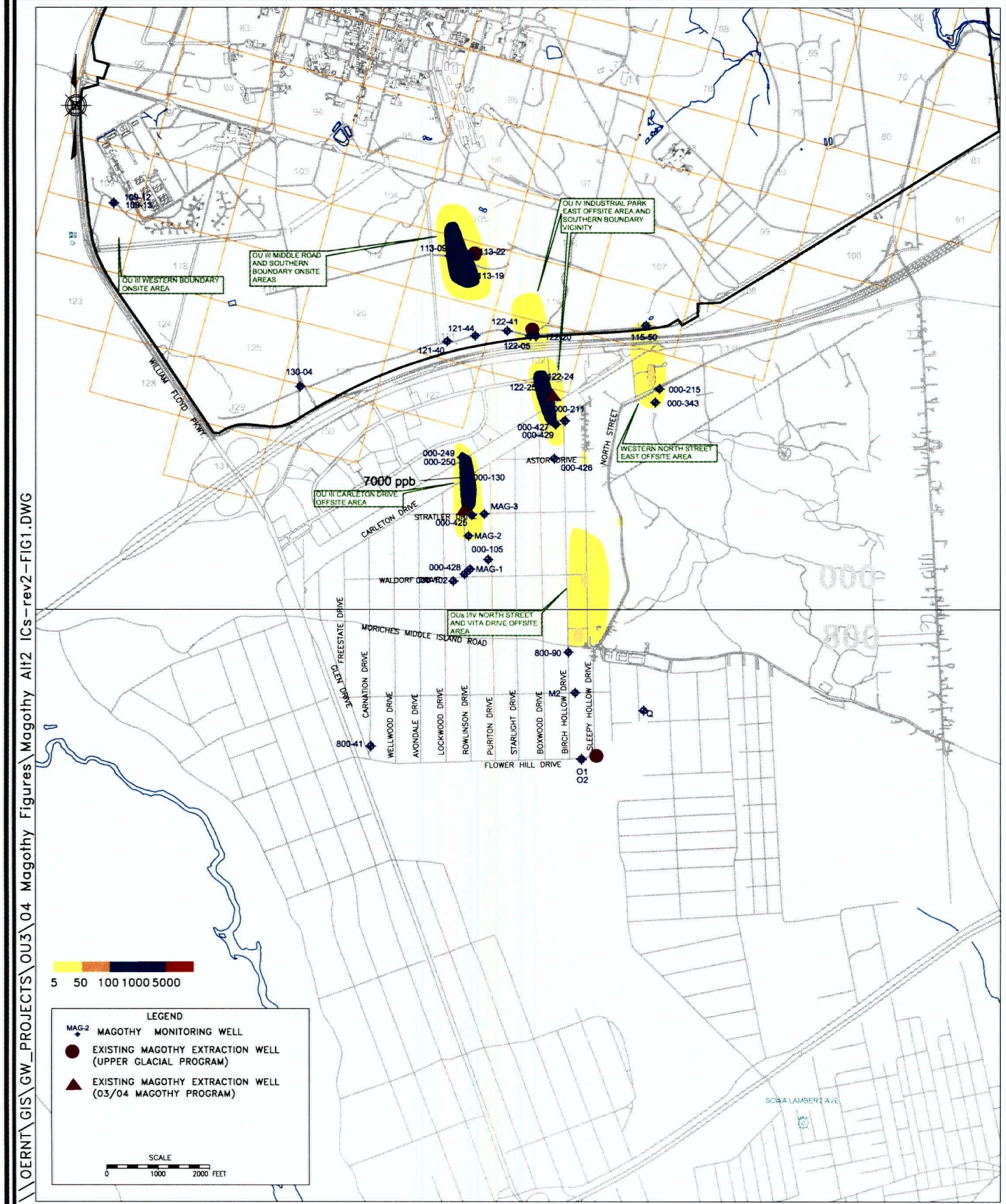
PUBLIC PARTICIPATION ACTIVITIES

While a public comment period is not required when issuing an ESD, DOE is interested in receiving public input on these changes. DOE will accept comments on the OU III ESD from December 6, 2004 through January 14, 2005. To submit comments, you may send an email to tellDOE@bnl.gov, fax to (631) 344-3444, or write to:

Mr. Michael Holland
Site Manager, Brookhaven Site Office
Attn: ESD
U.S. Department of Energy
P.O. Box 5000
Upton, NY 11973

Additionally, there will be a public information session about these changes on January 5, 2005 from 7 pm to 9 p.m. at Brookhaven National Laboratory's Berkner Hall, Room B. Interested members of the public are invited to learn more about the ROD changes and the cleanup projects.

The ESD is available on the web at http://www.bnl.gov/erd/groundwater.html The ESD and other relevant documents are part of the Administrative Record file for the BNL site. The Administrative Record includes, among other things, the ROD and technical documents. These documents are available for review at the Mastic-Moriches-Shirley, BNL Research, and EPA Region II libraries.



\\OERNT\GIS\GW_PROJECTS\OU3\04 Magothy Figures\Magothy Alt2 ICs-rev2-FIG1.DWG

BROOKHAVEN NATIONAL LABORATORY

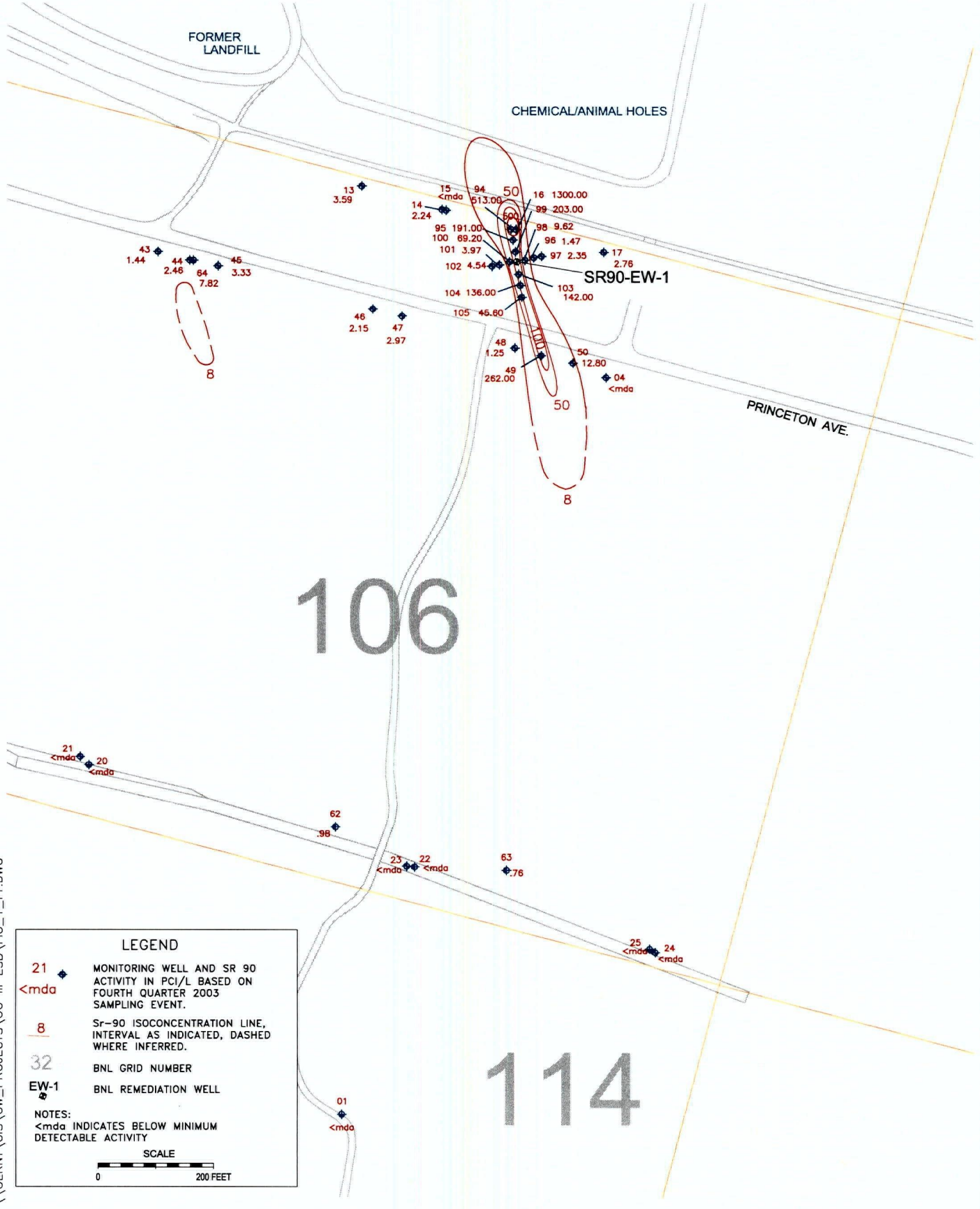
GROUNDWATER PROTECTION PROGRAM

TITLE:

MAGOTHY AQUIFER PLUME Alternative 2–STARTING TVOC CONCENTRATION (PPB)

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
DBB	–	03/03/04	07280
CHKD:	APPD:	REV.:	NOTES:
RH		–	–

FIGURE NO.: 1



BROOKHAVEN NATIONAL LABORATORY

GROUNDWATER PROTECTION PROGRAM

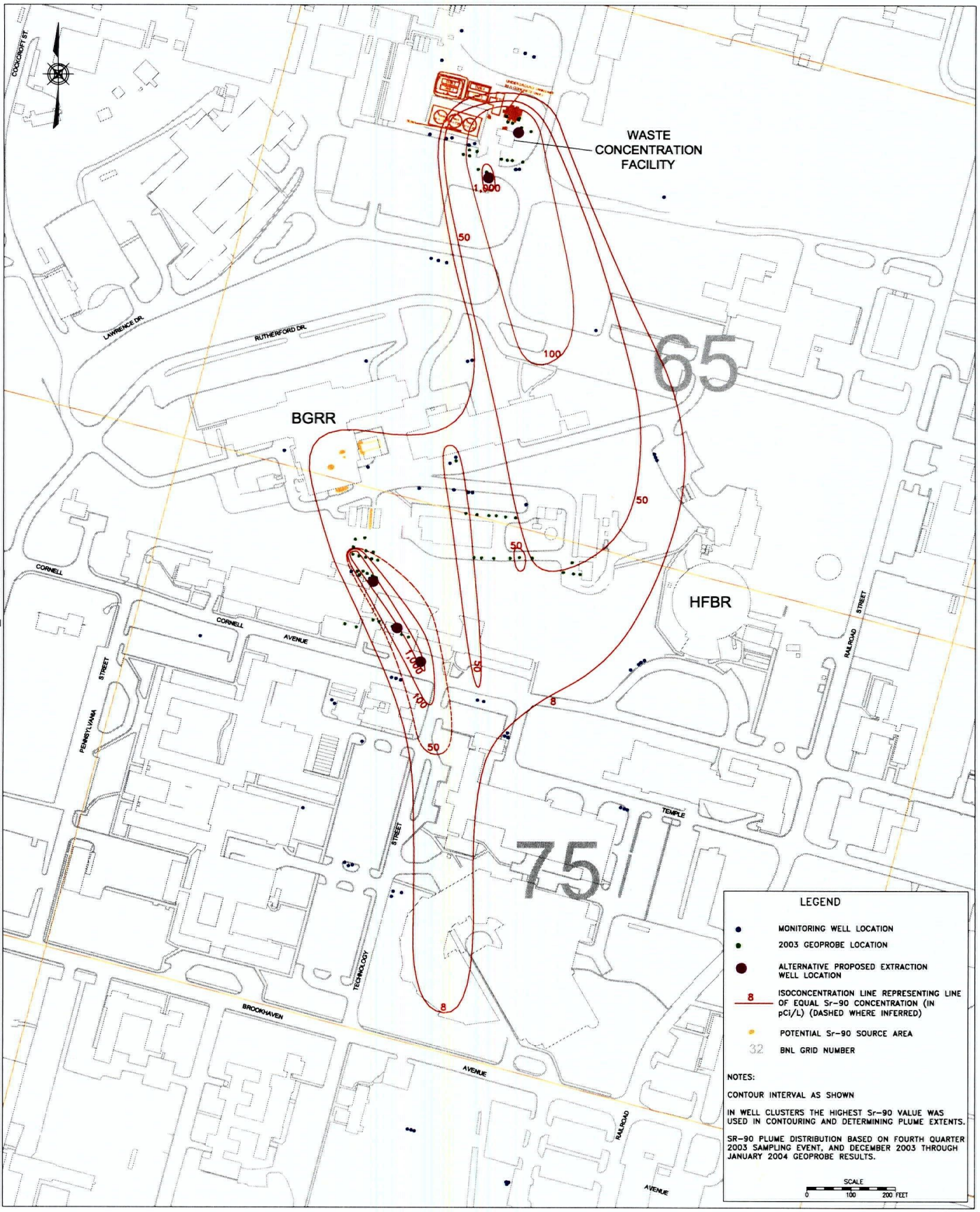
TITLE:

CHEMICAL/ANIMAL HOLES Sr-90 2003 PLUME DISTRIBUTION

OU III Explanation of Significant Differences

DWN:	VT:HZ.:	DATE:	PROJECT NO.:
ALR	–	06/01/04	07176
CHKD:	APPD:	REV.:	NOTES:
WRD	WRD	–	–

FIGURE NO.: 2



\\OERNT\GIS\GW_PROJECTS\OU III\BGRR\LATEST CRISIS\MULTIPLE PUMPING SCENARIOS\ALT 3 25 GPM_FIG3.DWG

BROOKHAVEN NATIONAL LABORATORY

GROUNDWATER PROTECTION PROGRAM

TITLE:

OU III BGRR Sr-90 GROUNDWATER MODEL ALTERNATIVE 3 25 GPM

DWN:	VT: HZ.:	DATE:	PROJECT NO.:
KCK	–	02/13/04	07183
CHKD:	APPD:	REV.:	NOTES:
DBB	TMB	1	draft

FIGURE NO.: 3

Table 1

Magothy Aquifer Contamination

Location	Max. TVOC[a] (ppb[b])	Primary VOCs	Results
western boundary on-site	<5.0	NA	Magothy not impacted. Two monitoring wells serve as adequate outpost/sentinel wells for Suffolk County Water Authority William Floyd wellfield.
Middle Road and south boundary on-site	340	PCE, CCl4	VOCs identified in upper 20 to 40 feet of Magothy at Middle Road area where brown clay is absent. TVOCs also detected at approximately 2,000 ppb in 1999 in lower portion of Upper Glacial. VOCs not detected at south boundary beneath the clay.
North Street off-site	50	TCE	Low TVOC concentrations have been detected in localized areas in the upper 30 feet of Magothy below hole in brown clay and downgradient near Vita Drive where clay exists. Leading edge of contamination is around Moriches Middle Island Road.
North Street East off-site	30	11-DCA, 11-DCE	Low TVOC concentrations have been detected at the BNL south boundary to North Street below the brown clay at approximately 40 to 150 feet in the upper Magothy. Tritium also co-located with VOCs upwards of 4,660 picoCuries/liter (pCi/l) (13,600 pCi/l detected in 1998).
Industrial Park East off-site and south boundary	570	TCA, CCl4	Lower VOC concentrations on-site (less than 50 ppb) and higher (more than 500 ppb) off-site in the Industrial Park where brown clay is absent. Magothy and Upper Glacial contamination is contiguous in Industrial Park.
South of Carleton Drive offsite	7,200	CCl4	High VOC concentrations just south of Carleton Drive where brown clay is absent. Contamination is contiguous between Magothy and Upper Glacial Aquifer.

[a] Total Volatile Organic Compounds
[b] **parts per billion**

Table 2

Magothy VOC Alternatives

Alternative Number	Alternative Description	Years to Reach MCLs[1]	Capital Cost (in $K)	O&M[2] Cost (in $K)	Total Cost (in $K)
1	Existing three* Magothy wells and additional monitoring	110	400	1,100	1,500
2	Existing three* wells Plus two additional Magothy wells, and monitoring	65	825	1,520	2,345
3	Existing three* wells plus seven additional Magothy wells, and monitoring	30	3,900	11,290	15,190

[1] – Maximum Contaminant Level
[2] – Operations and Maintenance

* Note: Costs for the three existing Magothy extraction wells are not included here (they were previously covered in the OU III ROD costs as part of the Upper Glacial systems)

Table 3

Proposed Magothy Remedy

	Area Investigated	Alternative 2 Selected Remedy
1	Western boundary onsite area	Good well network in place. Continue monitoring and evaluate data.
2	Middle Road and south boundary onsite area	Continue operation of the Magothy extraction well at Middle Road, as well as the two Upper Glacial systems. Continue to monitor the three Magothy monitoring wells at Middle Road and three at the south boundary. An additional monitoring well (121-44) at the south boundary was installed in 9/03.
3	North Street off-site area	Continue operation of the two existing Upper Glacial extraction wells on Sleepy Hollow Drive and North Street to prevent further Magothy contamination. Four additional wells (M-2, O-1, O-2, Q) were installed in 2003 to help integrate the North Street and Airport system's monitoring well network. Continue monitoring and evaluate data.
4	North Street East offsite area	Good well network in place. Continue monitoring and evaluate data.
5	Industrial Park East offsite area and south boundary	Continue operation of the partial Magothy extraction well at the southeast boundary. Include an additional extraction well at the interface of the Upper Glacial and Magothy Aquifers for the Industrial Park East treatment system. This will prevent migration of high concentrations of VOCs through the hole in the brown clay and into the Magothy Aquifer. The extraction well was installed January 2004. Continue monitoring and evaluate data.
6	South of Carlton Drive offsite area	Modify the LIPA/Airport treatment system to include an additional extraction well at the interface of the Upper Glacial and Magothy Aquifers on Stratler Drive. This will prevent migration of high concentrations of VOCs through the hole in the brown clay and into the Magothy Aquifer. The extraction well was installed in March 2004. Three additional monitoring wells (Mag-1, Mag-2, Mag-3) were installed in 12/03 and 1/04. Continue monitoring and data evaluation.

Table 4
Strontium-90 Alternatives

Alternative	Flow GPM	Pumping Wells	Years To Reach DWS	Pumping Years	Monitoring Years After Pumping	Capital	O&M	Total
1	0	0	118 yrs	0 yrs	118 yrs	$ 251,511	$ 3,282,480	$ 3,533,991
2	15	3	94 yrs	10 yrs	84 yrs	$ 1,682,338	$ 7,108,884	$ 8,791,222
3	25	5	67 yrs	10 yrs	57 yrs	$ 1,742,338	$ 7,716,027	$ 9,458,365
4	43	5	67yrs	10 yrs	57 yrs	$ 1,742,338	$ 9,839,670	$ 11,582,008
5	73	7	63yrs	10 yrs	53 yrs	$ 1,802,338	$ 18,852,388	$ 20,654,726
6	118(10 yrs) 55 (10 yrs)	9 9	44 yrs	10 yrs +10 yrs 20 yrs	20 yrs	$ 1,862,338	$ 22,340,260 $ 12,794,976 $ 35,135,236	$ 36,997,574
7	128 (10 yrs) 55 (20 yrs)	10 10	30 yrs	10 yrs +20 yrs 30 yrs	0 yrs	$ 1,892,338	$ 24,043,163 $ 24,686,966 $ 48,730,129	$ 50,622,467

Table 5

Strontium-90 Remedy Summary

	OU III ROD	ESD
Scope	BGRR/WCF Plume: Pump and treat system using two wells Prevent or minimize plume growth Meet drinking water standards within 30 years Chemical Holes Plume: Pump and treat system using one well Prevent or minimize plume growth Meet drinking water standards within 30 years	BGRR/WCF Plume: Pump and treat system using five wells Prevent or minimize plume growth Meet drinking water standards within 70 years Chemical Holes Plume: Pump and treat system using one well Prevent or minimize plume growth Meet drinking water standards within 40 years
Performance	BGRR/WCF Plume: Meet drinking water standards in the aquifer through active remediation Chemical Holes Plume: Meet drinking water standards in the aquifer through active remediation	BGRR/WCF Plume: Meet drinking water standards in the aquifer through active remediation Chemical Holes Plume: Meet drinking water standards in the aquifer through active remediation
Cost	$6.5 million (The present worth value is $5,800,000) $55.7 million (latest revised estimate based on ROD assumptions)	$14 million